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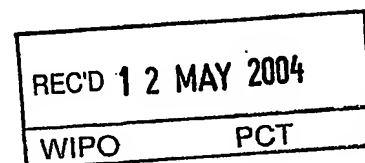*Date of filing*

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MBMS linking for PMM idle mobiles

FIELD OF THE INVENTION

The present invention relates to notifications of an MBMS
5   Session start to CS-connected mobiles that are PMM idle.

BACKGROUND OF THE INVENTION

The work item Multimedia Broadcast Multicast Service (MBMS)
10   is currently being standardised for release 6 within 3GPP.
There are two modes of operation defined, the broadcast and
the multicast mode. This invention relates to the multicast
mode.

MBMS Data is initiated with a Session Start message sent
15   from the SGSN to all the RNC that have joined MBMS mobiles
for that service. An RNC is considered to have mobiles if
it:

1. Includes a RA where there are PMM-IDLE UE:s (user
equipments) that have joined the MBMS service.

20   2. It is acting as an SRNC for a PMM-CONNECTED UE which has
joined the MBMS service.

3. The RNC indicates with a MBMS REGISTRATION REQUEST
message, that there are UE:s under this RNC. This is in case
the RNC acts as a D-RNC for a UE that has joined the MBMS
25   service.

Further, the SGSN is responsible to indicate to the SRNC for each UE that is PMM-CONNECTED and that has joined a certain MBMS service through the UE linking procedure, i.e. the SGSN sends the IMSI with a list of MBMS services to the SRNC.

5 Only PMM-CONNECTED UE:s are explicitly known in the SRNC and can get the corresponding message to Session start on the Uu-interface. For a UE that is PMM-IDLE and that has an ongoing speech call (CS-Connected), the SRNC has no knowledge about that the UE has joined the MBMS service and
10 the UE will not listen to broadcast of potential indications to start the MBMS transmission.

DETAILED DESCRIPTION OF THE INVENTION

15 Some solutions to this problem to solve the PMM-IDLE UE problem are discussed in the following:

One existing solution (solution#1) is outlined in chapter 8.2.4 and 8.2.5 of the document 3GPP TS 25.436 v2.4.0, Introduction of Multimedia Broadcast Multicast Service
20 (MBMS) in the Radio Access Network (Stage 2), Release 6: When the UE transits to RRC Connected while in PMM-IDLE, it sends a MBMS JOINED SERVICE INDICATION message to the SRNC. This contains a list of the MBMS services the UE has joined and is stored in the RNC as long as the UE is RRC Connected
25 and PMM-IDLE (e.g. doing a speech call).

It is another conceivable solution (solution#2) that all UE:s that have joined an MBMS service are required to enter PMM-CONNECTED in case they transit to RRC Connected for any reason. By requiring this a UE that is performing a speech
30 call will be in PMM-CONNECTED and be linked in a normal

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fashion and the SRNC will know that the UE have joined an MBMS service.

Still another solution (solution#3) might be when the SGSN sends the session start to an RNC it also includes all the
5　UE ID:s, of UE:s that have joined that MBMS service and that are in PMM-IDLE and in a Routing Area (RA) with cells belonging to that RNC. The RNC could then check these UE identities against all the identities for which the RNC have an active RRC context identifying all the RRC connected and
10　PMM-IDLE UE:s. The RNC then sends a dedicated indication to all UE:s that are PMM-IDLE but RRC connected that the MBMS transmission is starting.

Another solution (solution#4) is similar to the previously mentioned solution that the SGSN sends the session start to
15　an RNC it also includes all the UE ID:s, of UE:s that have joined that MBMS service and that are in PMM-IDLE and in a RA with cells belonging to that RNC. The RNC could then check these UE identities against all the identities for which the RNC have an active RRC context identifying all the
20　RRC connected and PMM-IDLE UE:s. However, instead (compared to the previous solution) the RNC then sends a MBMS PMM-CONNECTED STATE REQUIRED IND message making the UE:s transit to PMM-CONNECTED, making the SGSN initiate the UE linking. This will also result in that the mobiles get an indication
25　about that the MBMS transmission is starting in a similar manner as for UE that were PMM-CONNECTED from the beginning.

It is thus a disadvantage that the load in the RNC cross checking the list. The load in the SGSN for all UE:s is linked at the same time. Also the load requirement is very
30　instantaneous colliding with the time instant when the service is started and the RNC potentially also need to perform counting of MBMS mobiles. All these procedures

potentially include Uu signaling leading to air inte
congestion.

It is the basic concept of the present invention
instead of performing a similar procedure as the UE li:
5   between the SRNC and the UE as indicated in the pre·
solutions, this procedure is performed only between the
and the SRNC.

In the situation where a UE has joined MBMS services ar
in PMM Idle state, the knowledge of joined service(s
10   currently not known by UTRAN. As a consequence, and in
a PMM Idle UE moves to RRC Connected state due to
connection, the SRNC would be unable to alert such a UE
receipt of SESSION START from the SGSN.

In order to address this issue, the information of j·
15   service shall be provided to the SRNC:

- either by the PMM Idle UE, when ent·
RRC Connected state,

- either through Iu Linking pro·
assuming UEs in PMM Idle RRC Conn·
20   state are mandated to become
Connected,

- or by specifying that the SRNC it
shall fetch this information from
SGSN.

25   Advantageously, there is no duplication of MBMS lir
procedures. No extra linking on Uu between the UE and
RNC. Only the linking on Iu between the SGSN and

remains. The load in the RNC and the SGSN related to creating contexts, performing linking and processing of UE identities, for mobiles in RRC Connected and PMM-ILLE, are spread in time. The load on the air interface is spread over
5   time, reducing the risk for congestions.

The following table describes a comparison of pros and cons for various possible solutions. The present invention addresses in particular the solutions 5 (RNS initiated Iu-linking) and 6 (UE initiated Iu-linking).

	Pros	Cons
Scenario one – start indication available		
1) RRC MBMS Join	Simple, CN is not involved, fits well into current scheme with min impact on specifications	Assumes available start indication, requires new RRC message or Uu procedure
2) Scenario two – start indication not availble		
3) UE initiated MBMS context registration	Fits well into existing MM procedures, no impact on Ran interfaces	Additional authentication/security procedure may be required
4) RRC controlled UE PMM state transition	Less signalling on Iu	Complex require both Uu and MM procedures
5) RNC initiated Iu linking	Fits well into current specifications, no impact on Uu,	Increased signalling load on Iu, assumes available MBMS context info in SGSN
6) UE initiated Iu linking	Fits with smaller adjustment into current scheme, small additional load on Iu	Impact on Uu

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Figure 1 shows an RNC initiated Iu linking at CS speech set up (RRC Connected PMM Idle). When a UE sets up a CS connection and is entering RRC Connected PMM idle state, the SRNC sends a connectionless RNSAP RRC Connection Indication
15   message (1), indicating a transition to RRC Connected state for the UE. The SGSN then makes a check (2) with the stored MBMS context information and if the UE has activated MBMS for one or more sessions the SGSN invokes the Iu linking

procedure (3) by sending Iu Linking Request message to the SRNC.

The SRNC then updates the MBMS UE service context (4) and keeps the UE specific MBMS context information for the UE
5   stored as long as the UE is RRC Connected.

Note that there are two different approaches on how to handle the UE state at reception of CL RNSAP Connection Indication message. The UE may either be forced to PMM connected or it shall stay in PMM idle. Currently TS 25.346
10   only allows Iu linking of UEs in PMM Connected mode. Forcing UE to PMM Connected requires additional Uu signalling to the mobile.

This solution implies thus that the SRNC takes the initiative to fetch the information about joined services,
15   every time a PMM Idle UE becomes RRC Connected.

Figure 2 shows a UE initiated Iu linking at CS speech set up (RRC Connected PMM Idle). A UE in PMM-Idle will do a state transition from RRC idle to RRC Connected when a CS-speech or CS data connection is set up. When entering RRC Connected
20   PMM idle state the UE sends RRC MBMS Joined Indication (1) to update the UE MBMS context in SRNC for one or more MBMS sessions for which the UE has joined. By reception of RRC Joined Indication the SRNC will check if there is an established MBMS service context for the session. If there
25   is no MBMS service context for the session the SRNC will initiate the RANAP RNC Registration procedure (3) and updates the MBMS UE context. At session start the SRNC will be able to page the UE individually (based on the information received in Uu Joined procedure) to inform the
30   UE of session start.

There is no implicit registration associated with t
solution, i.e. the UE stays in PMM Idle during the CS ca
The purpose of RANAP RNC Registration message is to prov
the RNC identity to the SGSN for distribution of Sess
5   Start messages. The important thing is the creation of
MBMS UE context in SRNC, which is kept as long as the UE
in RRC connected. Due to mobility in RAN the UE may move
another RNC, during the CS call, where it needs to be p
on a dedicated channel if the session starts during the
10   call. This can either be accomplished by individual pag
over Iur or Iur linking (Start indication received over I
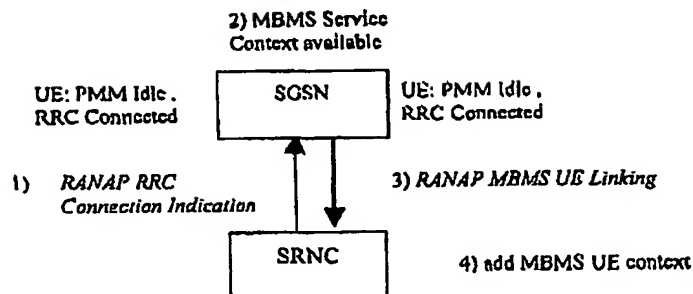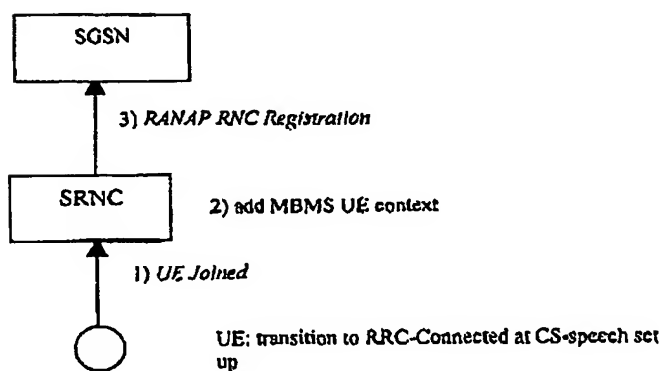UE joined can be implemented in RRC Connection Request or
a new RRC PDU.

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2) MBMS Service
Context available

UE: PMM Idle.
RRC Connected

SGSN

UE: PMM Idle,
RRC Connected

1) *RANAP RRC
Connection Indication*

3) *RANAP MBMS UE Linking*

SRNC

4) add MBMS UE context

Figure 1

SGSN

3) *RANAP RNC Registration*

SRNC

2) add MBMS UE context

1) *UE Joined*

UE: transition to RRC-Connected at CS-speech set
up

Figure 2